

WHAT IS CLAIMED IS:

1. A method of processing information by using an operational nucleic acid, comprising

(a) converting arbitrary information into a nucleic acid molecule;

(b) hybridizing the nucleic acid molecule obtained in said (a) to an operational nucleic acid designed so as to express a logical equation indicating a condition to be detected, and extending the nucleic acid molecule hybridized; and

(c) detecting a binding profile of the nucleic acid molecule included in the nucleic acid molecule extended in said (b), thereby evaluating whether a solution of the logical equation is true or false.

2. The method of processing information according to claim 1, wherein said nucleic acid molecule is an orthonormal nucleic acid.

3. The method of processing information according to claim 1, wherein said operational nucleic acid is configured of a plurality of sequence units, a sequence of each of the sequence units and the arrangement of the sequence units can be designed in accordance with the logical equation, and true or false of the logical equation is evaluated based on the binding of the nucleic acid molecule to each unit and extension thereof.

4. The method of processing information according

to claim 1, wherein said operational nucleic acid is
configured of a plurality of sequence units and a
marker binding portion, the sequence of each of the
sequence units and the arrangement of the sequence
5 units can be designed in accordance with the logical
equation, when said nucleic acid molecule binds to one
of the units and is extended so that a marker does not
bind to the marker binding portion, true or false
determination of the logical equation is made whether
10 or not a marker binds to the marker binding portion.

5. The method of processing information according
to claim 1, wherein said operational nucleic acid is
configured of a plurality of sequence units and a
marker binding portion, a sequence of each of the
15 sequence units and the arrangement of the sequence
units can be designed in accordance with the logical
equation which is formulated on the basis of the
combination of presence and absence of a target nucleic
acid, when said nucleic acid molecule binds to one of
20 the units and is extended so that a marker does not
bind the marker binding portion, true or false
determination of the logical equation is made whether
or not a marker binds to the marker binding portion.

6. A method of processing information using an
25 operational nucleic acid, comprising

(a) selecting target sequences, and further
selecting "presence" or "absence" of the target

sequences as a condition, formulating a logical equation based on the selected sequences and combination of the presence or absence of the target sequences selected, and designing and preparing an
5 operational nucleic acid in accordance with the logical equation;

(b) when the target sequence selected in said (a), is present, information "the target sequence is present" being converted into a "presence molecule",
10 whereas, when the target sequence is absent, information "the target sequence is absent" being converted into an absence molecule;

(c) hybridizing a presence/absence oligonucleotide previously prepared on the basis of the
15 condition selected in said (a) with the presence molecule obtained in said (b) and extending the presence molecule;

(d) after step (c), recovering a single-stranded presence/absence oligonucleotide which has failed in
20 forming a double strand because a desired information is absent;

(e) hybridizing the absence molecule to the presence/absence oligonucleotide recovered in (d), thereby extract the absence molecule;

25 (f) hybridizing the presence molecule and absence molecule extracted in said (b) and (e), respectively, to the operational nucleic acid prepared in said (a)

and expending the presence molecule and absence molecule; and

(g) detecting binding profiles of the presence molecule and the absence molecule in the extended molecule obtained in said (f), thereby evaluating true or false of a solution of the logical equation.

7. The method of processing information according to claim 4, wherein said presence molecule and said absence molecule are orthonormal nucleic acids.

8. The method of processing information according to claim 4, wherein said operational nucleic acid is configured of a plurality of sequence units, a sequence of each of the sequence units and the arrangement of the sequence units can be designed in accordance with the logical equation, and true or false of the logical equation is evaluated based on the binding of the nucleic acid molecule to each unit and extension thereof.

9. The method of processing information according to claim 4, wherein said operational nucleic acid is configured of a plurality of sequence units and a marker binding portion, a sequence of each of the sequence units and the arrangement of the sequence units can be designed in accordance with the logical equation, when said nucleic acid molecule binds to one of the units and is extended so that a marker does not bind to the marker binding portion, true or false

determination of the logical equation is made whether or not a marker binds to the marker binding portion.

10. The method of processing information according to claim 4, wherein said operational nucleic acid is
5 configured of a plurality of sequence units and a marker binding portion, a sequence of each of the sequence units and the arrangement of the sequence units can be designed in accordance with the logical equation which is formulated on the basis of the
10 combination of presence and absence of a target nucleic acid, when said nucleic acid molecule binds to one of the units and is extended so that a marker does not bind to the marker binding portion, true or false determination of the logical equation is made whether
15 or not a marker binds to the marker binding portion.

11. The method of processing information according to claim 4, wherein said molecule is a nucleic acid.

12. A method of processing information using an operational nucleic acid for evaluating a logical OR or
20 logical AND which corresponds to the presence or absence of the nucleic acid having a specific sequence or using an operational nucleic acid for evaluating a logical OR and a logical And.

13. A molecular computer having an electronic
25 operation section and molecular operation section, wherein said electronic operation section controls a function of molecular operation section substantially,

and the molecular operation is performed under control of the electronic operation section.

14. A molecular computer comprising an electronic operation section and a molecular operation section;

5 wherein, in said electronic operation section, a constant and a variable of a computation program are converted into coding molecules, and a procedure and a function of the computation program are converted into an operation reaction; implementation steps of the
10 operation reaction are prepared from the computation program; and

 in said molecular operation section, in which coding molecules are stored, the operation reaction of the coding molecules is performed in accordance with
15 the implementation steps, whereby the results of the operation reaction are obtained or further detected.

15. A molecular computer comprising an electronic operation section and a molecular operation section;

 wherein said electronic operation section
20 comprises

 means inputting a computation program, a constant and a variable of a computation program;

 means converting the constant and variable of the computation program into a coding molecule;

25 means converting a procedure and a function of the computation program into a corresponding operational reaction of a coding molecule;

performing an operation of a part of the
computation program;

means preparing an implementation procedure of the
operation reaction in accordance with the computation
5 program or the operation results of the molecular
operation section; and

means controlling the operation reaction to be
performed in the molecular operation section in
accordance with the implementation procedure of the
10 operation reaction; and

said molecular operation section comprises
operation means performing the operation reaction
by using the coding molecule; and

detection means detecting the operation result
15 performed by the operation means.

16. A molecular computer comprising an electronic
operation section and a molecular operation section;

wherein said electronic operation section
comprises

20 means inputting a computation program, a constant
and a variable of a computation program;

means converting the constant and variable of the
computation program into a coding molecule;

means converting a procedure and a function of the
25 computation program into a corresponding operational
reaction of a coding molecule;

performing an operation of a part of the

computation program;

means preparing an implementation procedure of the operation reaction in accordance with the computation program or the operation results of the molecular operation section; and

means controlling the operation reaction to be performed in the molecular operation section in accordance with the implementation procedure of the operation reaction; and

means displaying the operation results detected by the molecular operation section; and

said molecular operation section comprises operation means performing the operation reaction by using the coding molecule; and

detection means detecting the operation result performed by the operation means.

17. A molecular computer comprising

input means inputting a computation program for computation;

storage means storing the computation program input

operation means operating a part of the computation program;

storage means storing a molecule conversion table for assigning the computation program, and a constant and a variable of the computation program to coding molecules;

conversion means converting the computation program, and the constant and the variable of the computation program to coding molecules by reading the molecule conversion table and screening and reading out corresponding data stored therein;

synthesis means synthesizing the coding molecule;

storage means storing a procedure conversion table for converting the computation program into an experimental operation of the coding molecule;

plan preparation means preparing an experimental design by reading out the procedure conversion table, screening and reading out the corresponding data and converting the corresponding data into an experimental operation;

automatic control means outputting a driving signal in accordance with the experimental means prepared;

experimental means operating the experimental operation in accordance with the driving signal from the automatic control means by using the coding molecule synthesized;

detection means detecting the coding molecule obtained from the experimental operation;

processing means processing detection results into a form written in the computation program; and

an output means outputting results obtained by the processing means.

18. The molecular computer according to any one of claims 13 to 16, wherein said molecular operation section has a means for synthesizing the coding molecule.

5 19. The molecular computer according to any one of claims 13 to 17, wherein said molecule is a nucleic acid.

10 20. A molecular computation method integrally functioning an electronic operation section and a molecular operation section on the basis of molecular information recognizable by an electric program.

15 21. A molecular computation method integrally functioning an electronic operation section and a molecular operation section on the basis of molecular information recognizable by an electric program.

20 22. A software applicable to a molecular computer comprising an electronic operation section and a molecular operation section, wherein said software is applied to the electronic operation section and/or the molecular operation section; and an operation to be performed in the electronic operation section and an operation to be performed in the molecular operation section are allowed to function in an operation section of each of the electronic operation section and the
25 molecular operation section, in the form of data electrically recognizable.

23. The software applicable to a molecular

computer according to claim 22, comprising a function for converting data obtained at the molecular operation section into data form applicable to an electric program of the molecular operation section.

- 5 24. The software applicable to a molecular computer according to claim 22, comprising a function for converting data obtained at the electronic operation section into data form applicable to an operation of the molecular operation section.

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